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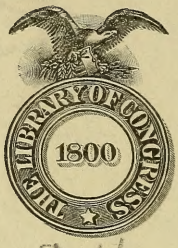
THE MUSSELS OF THE BIG BUFFALO FORK OF THE WHITE RIVER, ARKANSAS

By Seth Eugene Meek.



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DEPARTMENT OF COMMERCE AND LABOR
BUREAU OF FISHERIES
GEORGE M. BOWERS, Commissioner

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Bureau of Fisheries Document No. 759

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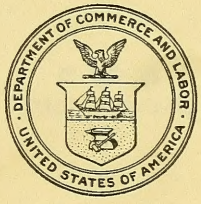

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THE MUSSELS OF THE BIG BUFFALO FORK OF WHITE RIVER, ARKANSAS

By S. E. MEEK and H. WALTON CLARK

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THE MUSSELS OF THE BIG BUFFALO FORK OF WHITE RIVER, ARKANSAS.

By S. E. Meek and H. Walton Clark.

PHYSICAL AND BIOLOGICAL CONDITIONS.

The Big Buffalo River drains a considerable portion of the northern slope of the Boston Mountains. It is a winding stream bordered on its outer curves by bluffs, most of which rise perpendicularly from the water to a height of 20 to 400 feet or more. In many places back from these bluffs the highest mountains rise quite abruptly to a height of about 1,500 feet above the river. The immediate banks were estimated to be from 10 to 30 feet high. In many places where a root hold can be had on the face of these bluffs stunted cedars are growing, and these become more numerous and taller along its upper margin. The slopes and tops of the mountains support a considerable forest of oak and pine. The river valley is narrow, which is also true of all its tributaries. In dry weather the river is little more than a creek, and such it is usually called by the residents; but in wet weather it often becomes a raging mountain torrent. In its lower course it has been known to rise 30 feet or more in one day.

Prof. W. N. Gladson, of the University of Arkansas, to whom the party was indebted for many courtesies, examined the river for mussels between Boxley and a point about 10 miles above the ford on the road from Harrison to Jasper. No shells were found in this portion of the river except a few in the last mile or two.

The bed of the portion of the stream visited varied in width from about 30 feet to 200 feet. Over many shoals the water was not deep enough to float the boats, which drew only about 5 inches of water, and in the long, deep holes it seldom exceeded a depth of 6 feet. Along the course of the river are many sand and gravel bars, which seem to shift more or less with each freshet, leaving, perhaps, less than half the river in anything like a permanent bed.

Mussel beds, as compared with those on the White River, were neither large nor plentiful, and these occupied only the favorable

places in the bed of the stream which appeared to be permanent. No beds were found on sand bars, and when found on gravel bars the sand and gravel were mixed with larger fragments of rocks. It would be quite impossible to collect shells in this stream with tongs or drags such as are successfully used on the Illinois River in Illinois. Nowhere were shells found in abundance, and if all shells taken out by the pearl hunters could be used in the manufacture of buttons there could certainly not be much profit in collecting and transporting them.

Notwithstanding the statements of some pearl hunters that a bed can be worked thoroughly one season and as many shells found there the following one, the general impression is that the mussels are not so abundant as formerly. During the low water the hogs eat all that they are able to obtain, and are, no doubt, partially responsible for the depletion of many beds in the upper course of the stream. Inquiries were made as to shells in the smaller tributaries, and the answer was either "none" or "very few." Along the portion of the river examined the beds have all been very thoroughly worked annually for the past few years by pearl hunters, and work of this nature was being carried on energetically in 1910.

It seems that a stream which varies so greatly in volume as this one does, so much of its bed changed by freshets, with scarcely any permanent sand bars, would not furnish conditions for an abundant growth of mussels. Between Boxley and a point about 10 miles above the ford on the Harrison-Jasper road only one small bed was observed.

The distance between our first and last camps was 95.8 miles, and the difference in elevation was 402 feet, or about 4.2 feet per mile. The fall for the first 15 miles was about 4.3 feet per mile, and in the last 15 miles 3.2 feet per mile. Between our camps of July 28 and July 30 the fall was 4.9 feet per mile for a distance of about 15 miles.

During the trip the river was gauged at three places with the following results: The flow of Buffalo River above the forks of Little Buffalo, sec. 8, T. 16 N., R. 20 W., on July 22 was 43.6 cubic feet per second, the gauge height at Gilbert on this day being 3.6 feet; the width of water was 54 feet. On July 26, in sec. 35, T. 16 N., R. 20 W., below the forks the flow was 85.19 cubic feet per second, with a gauge height at Gilbert of 3.8; width 64 feet. On August 1 at Gilbert the flow was 137.4 cubic feet per second, gauge 3.2, width 68.

The following is a list of camps, giving the elevation of each and the distance from each to the next as furnished by Prof. Gladson. The measurements are stadia distances in feet between each station and the following one. The elevations are above mean sea level, Gulf of Mexico, from United States Geological Survey bench marks, Fayetteville, Ark.

CAMPS ON BUFFALO FORK OF WHITE RIVER, ARK.

Camp designation.	Location.	Elevation.	Stadia distance from preceding station.
	NEWTON COUNTY, ARK.	*Feet.*	*Feet.*
A	South line of sec. 34, T. 16 N., R. 21 W. of fifth principal meridian	828	
B	In N. W. ¼ sec. 12, T. 16, R. 20 W	793	22,756
C	Near center of N. ½ of sec. 8, T. 16 N., R. 20 W	765	22,380
D	S. E. ¼ of same section as above	758	5,374
E	S. W. ¼ sec. 35, T. 16 N., R. 20 W	724	32,556
F	E. ½ sec. 33, T. 16 N., R. 19 W	698	35,956
	SEARCY COUNTY, ARK.		
G	Center of sec. 31, T. 16 N., R. 18 W	664	36,992
H	S. ½ sec. 11, T. 15 N., R. 18 W	631	41,052
I	Near center of sec. 5, T. 15 N., R. 17 W	595	29,720
J	South of center of sec. 31, T. 16 N., R. 16 W	556	50,316
K	Center of S. ½ sec. 22, T. 16 N., R. 16 W	540	23,150
L	E. ½ sec. 13, T. 16 N., R. 16 W	517	36,978
M	E. ½ sec. 4, T. 16 N., R. 15 W	490	42,089
	MARION COUNTY, ARK.		
N	Near center of sec. 26, T. 17 N., R. 15 W	471	35,488
O	N. E. ¼ sec. 23, T. 17 N., R. 15 W	452	44,156
P	N. E. ¼ sec. 23, T. 17 N., R. 14 W	421	36,844

No special effort was made to collect fishes, and the few taken in Rush Creek and in a small stream near Mount Hersey were damaged by the swamping of a boat and were not brought out. A number of game fishes, including rock bass, green sunfish, long-eared sunfish, and small-mouth black bass were caught by casting. A yellow cat (*Leptops olivaris*) was taken on a set line, and some residents had taken with a spear some other catfishes, which were identified as *Ameiurus aujuilla*. Suckers (the common white sucker and the red horse) were apparently common. Small fishes were nowhere abundant, the more common species being *Notropis zonatus*. No large-mouth black bass were seen until near Red Cloud mine, where one specimen was taken, and a second one jumped into our boat at the last station, but below Red Cloud mine fly fishing was very poor as compared with that in the river farther up.

MUSSEL BEDS LOCATED.

The exact location of the various mussel beds was rather difficult of determination. So few people were living along the stream that it was impossible to learn the local names of the fords, bluffs, and many of the shoals. It was possible, however, to locate the camps quite accurately and to approximate the distance between them, which enabled us to locate the beds fairly well, since they are usually found on the outer or bluff side of the river. Following is a list of the approximate localities where the collections of shells were made:

Station 1.—July 21, camp A. Immediately above the second ford above Welche's, where the Harrison-Jasper stage crosses the river, a few shells were found on gravelly bottom. Farmers living near

here state that several years ago shells were quite numerous and that one man could then perhaps have gathered 400 pounds in one day. This bed had been worked for pearls and so devastated by hogs that mussels are now very scarce. The river in places was not more than 30 feet wide, and, especially on and near shoals, the bed was gravel and sand; between these shallow places the river widens to from 50 to 100 feet, and flows with a sluggish current 4 to 6 feet deep over a rocky and muddy bottom.

A short distance below camp A is a small bed from which about 20 shells belonging to three species were taken during an hour's search. Many of these were dead, and only five were retained for the collection.

Shells taken at station 1: Rock mussel, washboard, *Quadrula undulata*, very abundant; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, only one seen; *Strophitus edentulus*.

Station 2.—July 22, camp C. The character of the river was about the same as above. A few dead shells were observed, but no live ones were found.

Shells taken at station 2: White niggerhead, *Quadrula coccinea*, a few dead; rock mussel, washboard, *Quadrula undulata*, scarce; *Strophitus edentulus*, scarce; *Lampsilis planicostatus*, 1 specimen; butterfly, *L. ventricosus*, 1 live specimen, dead common.

Station 3.—July 23. From about 1 mile above to 1 mile below camp D.

Shells taken at station 3: Red niggerhead, *Quadrula tuberculata*, scarce; white niggerhead, *Quadrula coccinea*, scarce; *Unio gibbosus*, common; *Alasmidonta calceola*, 1 specimen; sand mussel, *Symphynota costata*, *Strophitus edentulus*, common; *Lampsilis venustus*, common; butterfly, *L. ventricosus*, abundant; *L. breviculus brittsi*.

After purchase of a wooden boat a trip was made down the Little Buffalo to the forks and back to camp. Inquiries were made along the river concerning shells in the Little Buffalo, all answers being to the effect that they were scarce and were always scarcer than in the Big Buffalo above the junction of these two streams. A local rain had swollen the stream and more water was flowing than in the Big Buffalo above the forks. It appeared to be the swifter of the two streams and its bed more rocky. From this camp to the mouth of the Little Buffalo the river flows mostly over gravel. A few dead shells were seen and fewer live ones were found. Just below the junction of the streams they were more numerous, but far from abundant. From about a mile below the forks to the next camp no beds were observed and but few shells or fragments of shell were seen on the shoals. Up to this time no shells were found which had been recently opened by pearl hunters.

Station 4.—July 26, camp E. Here there was a small mussel bed, where a few shells were taken.

Shells taken at station 4: White niggerhead, *Quadrula coccinea*, scarce; *Unio gibbosus*, abundant; niggertoe, *Alasmidonta truncata*, scarce; sand mussel, *Symphynota costata*, common; *Strophitus edentulus*, scarce; green mugget, red mugget, grass mucket, *Lampsilis ligamentinus*, *L. breviculus brittsi*, scarce.

Station 5.—July 26. About 2 miles below camp E a much larger bed was found. The pearl hunters had recently been here and about 100 freshly-opened shells were observed and a few live ones were found.

Shells found at station 5: Red niggerhead, *Quadrula tuberculata*, common; white niggerhead, *Q. coccinea*, scarce; cob shell, rabbit's foot, *Q. cylindrica*, 1 dead; sand mussel, *Symphynota costata*, abundant; green mugget, red mugget, grass mucket, *Lampsilis ligamentinus*, common; butterfly, *L. ventricosus*, scarce.

Station 6.—July 26. About 1 mile above camp F a small bed was observed, from which about 50 shells were taken during a search of and hour or more.

Shells found at station 6: Red niggerhead, *Quadrula tuberculata*, scarce; white niggerhead, *Q. coccinea*, common; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, common; young fantail, *Cyprogenia aberti*, scarce; spectacle case, *Lampsilis rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, scarce; butterfly, *L. ventricosus*, scarce; *L. breviculus brittsi*, scarce.

Station 7.—July 27. There were no beds of mussels observed for 3 or 4 miles below camp F, and very few dead or fragments of shells were found. About 1 mile above Mount Hersey a few shells were taken on a bed which extended through a longer course of the river. The shells, which were scarce, were found mostly among the larger rocks.

Shells found at station 7: Sand mussel, *Symphynota costata*, scarce; green mugget, red mugget, grass mucket, *Lampsilis ligamentinus*, scarce; *L. breviculus brittsi*, scarce.

None was found on an extensive sand and gravel bar at this point. The bed of the river is very rocky with quite extensive shoals both above and below Mount Hersey. A small bed was observed near the mouth of Cave Creek, its presence being made known by old shells and fragments on the gravel bars. No live mussels were seen, but a few were observed by one of the rodmen.

Station 8.—July 28. Above Wolem. A small mussel bed was observed about 1 mile below camp G. A much larger bed is located just above Wolem. Many mussels were seen here in the deeper water, and many had been recently opened by pearl hunters. This bed was at least three-quarters of a mile long, being much larger than any previously observed.

Shells found at station 8: White niggerhead, *Quadrula coccinea*, scarce; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*,

scarce; *Strophitus edentulus*, scarce; fantail, *Tritogonia tuberculata*, scarce; spectacle case, black sand-shell, *Lampsilis lienosus*, 7 taken; *L. venustus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, most abundant species; butterfly, *L. ventricosus*.

The river widens just below this bed and runs over a gravel bar, much of the water evidently flowing through the gravel. It was so shallow that the boats, which drew about 5 inches of water, passed with difficulty.

Station 9.—July 29. About 2 miles from camp H lay a mussel bed about one-half mile long on a shoal. Many shells had been opened, but none recently. Live mussels were plentiful, many of them lying in sand between rocks. On this, as well as other beds observed, the shells were in such rocky places that tongs or other appliances could not be used, and all shells taken by pearl hunters were taken by hand. In an hour's collecting about 150 live shells were secured.

Shells found at station 9: Red niggerhead, *Quadrula tuberculata*, very abundant; white niggerhead, *Q. coccinea*, scarce; *Unio gibbosus*, common; niggertoe, *Alasmidonta truncata; A. calceola*, 1 found; sand shell, *Symphynota costata*, abundant; *Lampsilis ozarkensis*, abundant; *L. venustus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, most abundant species; butterfly, *L. ventricosus*, scarce; *L. breviculus brittsi*, scarce.

Station 10.—July 29. About 5½ miles below camp H a small bed was found, and two other small beds were observed, one about 3½, the other about 5 miles from camp.

Shells found at station 10: Red niggerhead, *Quadrula tuberculata*, scarce; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, scarce; fantail, *Tritogonia tuberculata*, scarce; spectacle case, *Lampsilis rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, most abundant species.

Station 11.—July 30. About 2 miles below camp I there was a mussel bed less than one-half mile in length. Pearl hunters had opened many shells, but not recently.

Shells found at station 11: *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, scarce; spectacle case, *Lampsilis rectus; L. venustus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, abundant; butterfly, *L. ventricosus; L. breviculus brittsi*, scarce.

Station 12.—July 30. About 3½ miles below camp I a small bed was found.

Shells taken at station 12: White niggerhead, *Quadrula coccinea*, scarce; *Unio gibbosus;* sand mussel, *Symphynota costata; Strophitus edentulus*, scarce; spectacle case, *Lampsilis rectus;* green mugget, red mugget, grass mugget, *L. ligamentinus*, abundant; *L. breviculus brittsi*, scarce.

Station 13.—July 30. About one-half mile below this last bed was a much larger one. A boy and a man were here hunting pearls, but they would give no information on the subject. There were on the shore at this place about 4 or 5 bushels of recently opened shells, by far the greatest number so far observed in one place.

Shells taken at station 13: Red niggerhead, *Quadrula tuberculata*, abundant; white niggerhead, *Q. coccinea*, scarce; *Unio gibbosus;* sand mussel, *Symphynota costata; Lampsilis ozarkensis*, scarce; red mugget, green mugget, grass mucket, *L. ligamentinus.*

Station 14.—August 1. A short distance above camp J, which was near the railroad station at Gilbert, was a small mussel bed; no specimens taken. About one-half mile below Gilbert is a fairly large bed lying on coarse gravel with larger fragments of rock and some sand. The depth of the water was about 2 feet. Three men, hunting pearls, were sitting on the bottom and digging the shells up with their hands. Each shell was opened at once, and if no pearl was found it was dropped and another one taken, every portion of the bed being examined. These men insisted they could take all they could find, and the next year as many more could as easily be found. The nature of the bottom was such that tongs or other devices could not be used profitably, for there were too many fragments of rock much larger than the shells and many about the size of the shells. Many of the shells were embedded beside the larger fragments and in some cases partly under them. Where the water was deeper the shells were collected in a bag and taken to the shore and opened. At this bed there was less than a bushel of shells on shore, while three or four times that amount were strewn over the bottom where the men were working.

Shells found at station 14: Red niggerhead, *Quadrula tuberculata*, abundant; cob shell, rabbit's foot, *Q. cylindrica*, common; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, abundant; *Strophitus edentulus;* fantail, *Tritogonia tuberculata*, common; red shell, *Lampsilis purpuratus*, scarce; spectacle case, *L. rectus*, common; green mugget, red mugget, grass mucket, *L. ligamentinus*, abundant.

Station 15.—August 1. Below Gilbert, for about 2 miles, the current was quite rapid and the bottom very rocky. About 3½ miles below Gilbert was a considerable stretch of deeper water, bordered near the shallow water with sand and gravel bars. Mr. Cookson, a professional pearl hunter, had been working here for nearly a week. He had worked over the shallow places, and when we met him he was collecting in water about 5 feet deep. So many shells, he said, were between and under the edges of the larger rocks that tongs could not be used. His method was to have his sack for shells weighted down; by holding it with one hand he could draw himself under water and search for shells as long as he could hold his breath, after

which he would come to the surface, take a breath, and disappear again under water. During the week he had taken out of this bed about 10 bushels of shells, but did not believe many were left. From this bed a series was selected by Mr. Cookson and common names known to him were given them. Pearls, he says, are found mostly in the red and green muggets (muckets) and the washboards, and these shells are usually the most abundant. All shells taken, however, are opened for pearls. Mr. Cookson had hunted pearls for several years. He reported finding on an average pearls to the value of about $300 each year. The most valuable one found by him sold for $90.

Shells found at station 15: Red niggerhead, *Quadrula tuberculata*, common; white niggerhead, *Q. coccinea*, scarce; cob shell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, common; *Unio gibbosus;* niggertoe, *Alasmidonta truncata;* sand mussel, *Symphynota costata;* young fantail, *Cyprogenia aberti;* fantail, *Tritogonia tuberculata;* red shell, *Lampsilis purpuratus; L. ozarkensis;* spectacle case, *L. rectus;* red mugget, green mugget, grass mucket, *L. ligamentinus; L. breviculus brittsi.*

Station 16.—August 2. About 3 miles below camp K (Cookson's camp) a collection was made from a bed about the size of the one mentioned above.

Shells found at station 16: White niggerhead, *Quadrula coccinea*, scarce; cob shell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, more abundant than all other species; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, common; fantail, *Tritogonia tuberculata*, scarce; young fantail, *Cyprogenia aberti*, scarce; red shell, *Lampsilis purpuratus*, scarce; *L. glans*, 1 specimen; *L. ozarkensis*, common; spectacle case, *L. rectus; L. venustus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, abundant; butterfly, *L. ventricosus.*

Station 17.—August 2. About 5 or 6 miles below Cookson's camp a small bed was found and from it a collection was made. In the next mile two other very small beds were observed at the head of shoals in very rocky places. No collections were made from these beds.

Shells found at station 17: Red niggerhead, *Quadrula tuberculata*, abundant; white niggerhead, *Q. coccinea*, scarce; cob shell, rabbit's foot, *Q. cylindrica*, abundant; rock mussel, washboard, *Q. undulata*, abundant as all other species combined; *Unio gibbosus*, scarce; niggertoe, *Alasmidonta truncata*, sand mussel, *Symphynota costata*, scarce; *Strophitus edentulus*, common; fantail, *Tritogonia tuberculata*, scarce; *Lampsilis ozarkensis*, common; spectacle case, *L. rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, abundant.

Station 18.—August 3. About 1 mile from camp L a mussel bed was being worked for pearls by two farmers, the shells being col-

lected in sacks and opened on the bank. About 5 bushels of shells had been taken.

Shells found at station 18: Red niggerhead, *Quadrula tuberculata*, abundant; white niggerhead, *Q. coccinea*, scarce; cob shell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, very abundant; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, abundant; fantail, *Tritogonia tuberculata*, scarce; red shell, *Lampsilis purpuratus*, scarce; spectacle case, *L. rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, abundant.

Station 19.—August 3. Below station 18 for a mile or two were a few small beds which had recently been worked by pearl hunters. In all of these there was probably not more than a bushel of open shells.

Shells found at station 19: Red niggerhead, *Quadrula tuberculata*, very abundant; cob shell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, abundant; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, scarce; young fantail, *Cyprogenia aberti*, scarce; fantail, *Tritogonia tuberculata*, scarce; *Lampsilis ozarkensis;* green mugget, red mugget, grass mucket, *L. ligamentinus.*

Station 20.—August 3. About 6 miles below camp L and near the Jack Pot mine a small bed of shells was observed. About 1 bushel had been recently opened by pearl hunters. From these and a few live ones found a collection was made.

Shells found at station 20: Red niggerhead, *Quadrula tuberculata*, scarce; rock mussel, washboard, *Q. undulata*, common; fantail, *Tritogonia tuberculata*, scarce; red shell, *Lampsilis purpuratus*, scarce; *L. ozarkensis*, scarce; spectacle case, *L. rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, common.

Station 21.—August 4. About 1 mile below camp M were two beds of mussels. These had within a day or two been worked by pearl hunters, the shells being opened on the bank. Not more than 2 or 3 bushels had been taken from both of these beds, which were on the outer curve of the river and among more rocks than usual.

Shells found at station 21: Red niggerhead, *Quadrula tuberculata*, abundant; white niggerhead, *Q. coccinea*, scarce; cob shell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, abundant; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, scarce; *Strophitus edentulus;* fantail, *Tritogonia tuberculata*, scarce; spectacle case, *Lampsilis rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, common; butterfly, *L. ventricosus*, scarce.

Station 22.—August 4. About 5 miles below camp M a bed similar to the above was found and from it a collection was made.

Shells found at station 22: Red niggerhead, *Quadrula tuberculata*, common; cob shell, rabbit's foot, *Q. cylindrica; Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, scarce; fantail, *Tritogonia tuber-*

culata, scarce; red shell, *Lampsilis purpuratus*, common; green mugget, red mugget, grass mucket, *L. ligamentinus*, abundant.

Along the river on its outer bends a few very small beds were observed. Owing to the small number of shells, deeper water, and the large rocks, these beds were not worked by pearlers.

Station 23.—August 5. About 2 miles below camp N was found the largest bed observed. It was being worked by two men and two women who live near by and hunt pearls a portion of the time in July and August when their crops do not need their attention. They reported that pearls collected by them during the summer months brought them about $300. Mr. Samuel W. Jones, Rush, Ark., one of the men, stated that if all the shells found in one season were taken from the bed just as many would be found the next year. From this bed they estimated they would take about 25 bushels of shells. They had just begun work for the season. The most abundant species found here is *Lampsilis ligamentinus*, which, according to Mr. Jones, contains the most pearls. At this place this species was more abundant than all others combined.

Shells found at station 23: Rock mussel, washboard, *Quadrula undulata*, scarce; *Unio gibbosus*, scarce; fantail, *Tritogonia tuberculata*, common; green mugget, red mugget, grass mucket, *Lampsilis ligamentinus*, abundant.

Station 24.—August 5. About 1 mile above the Red Cloud mine we passed a bed of shells where pearl hunters had been, but it was very small compared to the above.

On all outward bends of the river were small beds, but these were passed by by pearl hunters, no doubt because shells were scarce, and on account of the rocks and deeper water they were difficult to get in any numbers. A short distance above and below the mouth of Rush Creek were small beds, the latter being worked by pearl hunters. No collection was made from these beds.

Shells found at station 24: Red niggerhead, *Quadrula tuberculata*, scarce; cobshell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, common; *Unio gibbosus*, common; sand mussel, *Symphynota costata*, scarce; fantail, *Tritogonia tuberculata*, scarce; red shell, *Lampsilis purpuratus; L. ozarkensis*, abundant; *L. planicostatus*, 1 specimen; spectacle case, *L. rectus*, scarce; *L. venustus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, abundant; butterfly, *L. ventricosus*, scarce; *L. breviculus brittsi*, scarce.

Station 25.—August 6. About 2½ miles below Red Cloud mine a large bed was found which had been recently visited by pearl hunters. On the shore were about 10 bushels of recently opened shells, from which a collection was made. On recently worked beds live shells were not easily found, for the pearlers aim to get everything.

Shells found at station 25: Red niggerhead, *Quadrula tuberculata*, common; white niggerhead, *Q. coccinea*, common; cob shell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, abundant; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, common; *Strophitus edentulus*, scarce; young fantail, *Cyprogenia aberti*, scarce; fantail, *Tritogonia tuberculata*, common; red shell, *Lampsilis purpuratus; L. ozarkensis*, scarce; spectacle case, *L. rectus*, common; green mugget, red mugget, grass mucket, *L. ligamentinus*, most abundant species; *L. luteolus*, two examples taken; butterfly, *L. ventricosus.*

Station 26.—August 6. In the next 2 or 3 miles a few small beds were found and then a second large one, where about 5 bushels of recently opened shells were seen.

Shells found at station 26: Red niggerhead, *Quadrula tuberculata*, common; cob shell, rabbit's foot, *Q. cylindrica*, scarce; sand mussel, *Symphynota costata*, scarce; spectacle case, *Lampsilus rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus.*

From this place to our next camp (camp P) very few shells were noticed.

Soon after camp P was established a succession of heavy thunder storms raised the river about 5 feet and the usually clear water became muddy. Under the most favorable circumstances it would be a week or more before any further observations regarding shells could be made, and so the work was discontinued here. Residents near here state that mussel beds occur from this point to the mouth of the river much the same as to number and abundance of shells as in a corresponding distance up stream from this place.

LIST OF MUSSEL SPECIES COLLECTED.

Local name.[1]	Common or trade name.	Scientific name.
Red niggerhead	Pink warty-back	Quadrula tuberculata.
White niggerhead		coccinea.
Cob shell, rabbit's foot		cylindrica.
Rock mussel, washboard	Blue-point	undulata.
———	Spike	Unio gibbosus.
Niggertoe	Elk-toe	Alasmidonta truncata.
———		calceola.
Sand mussel	Fluted shell	Symphynota costata.
———	Squaw-foot	Strophitus edentulus.
Young fantail		Cyprogenia aberti.
Fantail	Buckhorn	Tritogonia tuberculata.
Red shell		Lampsilis purpuratus.
———		glans.
———		ozarkensis.
———		planicostatus.
Spectacle case		lienosus.
Spectacle case	Black sand shell	rectus.
———		venustus.
Green mugget, red mugget, grass mucket		ligamentinus.
———	Fat mucket	luteolus.
Butterfly	Pocketbook	ventricosus.
———		breviculus brittsi.

[1] The local names given here are those furnished by pearlers along the river and differ considerably from the trade names among the shell buyers and manufacturers, so far is the Little Buffalo River from the influence of the active shell trade. In the button trade *Quadrula tuberculata, Q. coccinea, Alasmidonta caccella, Strophitus edentulus, Cyprogenia aberti, Lampsilis purpuratus, glans, ozarkensis planicostatus, lienosus, venustus,* and *breviculus brittsi* have no common names. *Q. undulata* is "blue-point," *Unio gibbosus* is "spike," *S. costata* is "fluted shell," *Tritogonia tuberculata* is "buckhorn," *L. ligamentinus* is simply "mucket," *L. luteolus*, "fat mucket," and *L. ventricosus* "pocketbook." On the other hand, the washboard of the trade is *Quadrula heros* and the butterfly is *Plagiola securis.*

DISTRIBUTION OF MUSSEL SPECIES.

Red niggerhead, Quadrula tuberculata (Rafinesque).—Rather common throughout the whole extent of the river traversed. The species is represented by 78 examples of various sizes, none very large and none very small. The shells do not exhibit much variation; they belong to a small, somewhat inflated type, much like those found in the streams of Kentucky and Tennessee. The specimens taken at station 6 were rather inflated compared with the others, and those obtained at station 26 were relatively small and thin. None were sufficiently inflated, however, to be regarded as *Q. granifera*, which differs from this species chiefly in degree of inflation, and none was so flat as the fine specimens of *Q. tuberculata* found in the Maumee, Tippecanoe, and Wabash Rivers, where the species appears to reach its finest development. All lacked the fine wavy sculpture of the umbones which is characteristic of the young of *Q. tuberculata* in its most perfect condition. The name "red niggerhead" was applied to this shell at the pearler's camp below Gilbert. On account of its colored and lusterless nacre this shell has little commercial value.

It was found at the following stations: 3, scarce; 5, common; 6, scarce; 9, very abundant; 10, scarce; 13, abundant; 14, abundant; 15, common; 17, abundant; 18, abundant; 19, very abundant; 20, scarce; 21, abundant; 22, common; 24, scarce; 25, common; 26, common.

White niggerhead, Quadrula coccinea (Conrad).—Although fairly well distributed, having been collected through nearly all the stretch of river traversed, and at 14 different stations, *Quadrula coccinea* does not appear to be common in the river. In all, 42 shells were obtained. The greatest number taken at one place was 9, collected at station 6. The shells are all rather small and moderately inflated. The greater number have white nacre, though a few are pink. At the pearler's camp it was called "white niggerhead." This species probably really belongs to *Pleurobema*, as Ortmann has found the outer gills only functioning as marsupia. It is, however, quite variable and may include several species. I have never found the common flat form gravid. An inflated form, identified as this, but approaching somewhat the shape of *Q. solida*, was found gravid in the Iroquois River and contained glochidia in only the outer gills. Where the species attains a good development the white-nacre shells furnish very fair button material, but the rather dwarf shells of the Big Buffalo River are of no commercial value.

It was found at the following stations: 2, a few dead shells; 3, scarce; 4, scarce; 5, scarce; 6, common; 8, scarce; 9, scarce; 12, scarce; 13, scarce; 15, scarce; 16, scarce; 17, scarce; 18, scarce; 21, scarce; 25, common.

Cob shell, rabbit's foot, Quadrula cylindrica (*Say*).—The first one, a dead shell, was taken at station 5. From here on it was, on the whole, rather common. The greatest number taken at any one place was 13, at station 25. In all, 59 examples were secured. At the pearler's camp it was called "cob shell." Along the Wabash it is known as "rabbit's foot." The nacre of all found is white, though many are more or less stained. Several were beautifully marked by green triangular marks and some were semitranslucent. None was young and most were of medium size. The species has no commercial value.

It was found at the following stations: 5, one dead; 14, common; 15, common; 16, common; 17, abundant; 18, common; 19, common; 21, common; 24, common; 25, common; 26, scarce.

Rock mussel, washboard, Quadrula undulata (*Barnes*).—Common to abundant throughout the part of the river examined and represented in the collection by 61 shells. The shells are of the same general type, medium in size and rather inflated. None is so compressed as the fine examples to be found in northern Indiana and Ohio and none so markedly inflated as to suggest *plicata*. Within the limits suggested there is some variation in the degree of inflation. Those obtained at station 16 are somewhat flat, and one is almost smooth. One obtained at the Jack Pot mine is markedly elongate as compared with the others, but not conspicuously so when compared with large series from elsewhere. The shells collected at station 26 are considerably eroded. The greater number of these shells exhibit well-marked costæ on the posterio-dorsal slope, with deep furrows between them. High ribs extending ventrad from the posterior slope and separated by deep furrows are also common. In these features the shells resemble a common type of the west and south and approach the style represented by Say's figure of *Unio costatus*. At the pearler's camp they were called "rock mussel," or "washboard."

Where this species attains good development it is a good commercial species, but the Big Buffalo shells are small and of poor quality.

It was found at the following stations: 1, most abundant; 2, scarce; 16, abundant; 17, abundant; 18, most abundant; 19, abundant; 20, common; 21, abundant; 23, scarce; 24, common; 25, abundant; 26, abundant.

Unio gibbosus (*Barnes*).—Common; represented in the collection by 77 specimens. As a usual thing only a few shells were obtained at a station. The greatest number obtained at one place was 10, collected at station 24. The most common form is the familiar medium-sized shell with violet nacre. Those obtained at station 3 and those collected at station 12 are large shells with white porcelaneous nacre. The five examples taken at station 6 are dwarfed specimens with

orange nacre, closely resembling a form common in Green River, Ky. This species is of no commercial importance.

It was found at the following stations: 1, scarce; 3, common; 4, abundant; 6, scarce; 8, scarce; 9, common; 10, scarce; 11, scarce; 14, scarce; 16, scarce; 17, scarce; 18, scarce; 19, scarce; 21, scarce; 22, scarce; 23, scarce; 24, common; 25, scarce.

Niggertoe, Alasmidonta truncata (*B. H. Wright*).—Rare; only seven shells obtained, one at station 4, one at station 9, another at station 12, and three at station 15, where it was called "niggertoe." Where it reaches its best development this is a beautiful shell. It is however, of no commercial importance.

Alasmidonta calceola (*Lea*).—Only two shells were collected, one at station 3 and one at station 9. This does not necessarily mean that it is rare, as on account of its small size and habit of burying itself in the bottom it is easily overlooked.

Sand mussel, Symphynota costata (*Rafinesque*).—A fairly common shell, found throughout the entire length of the river examined, and represented in the collection by 90 specimens. Most of the shells are of medium size, a few are smaller, but none very small, the smallest being about 3 inches long. There is no very marked variation among them; one specimen obtained at station 6 is compressed and somewhat deformed, and one from station 19, probably a female, is inflated, with deep costæ. At station 15 they were called "sand mussels." On account of the yellowish, lusterless nacre and usual thinness of shell, mussels of this species have no commercial value.

It was found at the following stations: 4, common; 5, abundant; 6, common; 7, scarce; 8, scarce; 9, abundant; 10, scarce; 11, scarce; 14, abundant; 16, common; 17, scarce; 18, abundant; 19, scarce; 21, scarce; 22, scarce; 24, scarce; 25, common; 26, scarce.

Strophitus edentulus (*Say*).—Although this shell is found throughout all the portion of the river examined, it is rather scarce nearly everywhere and nowhere abundant. One shell found at station 2 was short and truncate. The others were much alike and quite thin. *Strophitus edentulus* is an exceedingly variable shell, especially as regards thickness, and the nacre varies from bluish to yellowish. Even the best shells are of no commercial value.

It was found at the following stations: 2, scarce; 3, common; 4, scarce; 12, scarce; 17, common; 25, scarce.

Young fantail, Cyprogenia aberti (*Conrad*).—Not common; only 10 examples secured, the first one at station 6, and the last three at station 25. Most of the specimens are rather old and somewhat worn, a few are of medium size with the epidermis entire. Call suggests a resemblance between a young *C. aberti* and *Plagiola elegans*. The half-grown shells of this collection have rather the contour of *Quadrula lachrymosa*, but are without tubercles, only very low elongated

raised places, hardly pronounced enough to be called pustules, extending ventrad. The species is not nearly so pustulose as *C. irrorata* (Lea). The fine tesselated markings, green on a yellowish ground, sometimes disposed in broad rays, are similar to the color markings of the last-named species, and assist in identifying the species.

It was found at the following stations: 6, scarce; 16, scarce; 19, scarce; 25, scarce.

Fantail, Tritogonia tuberculata (*Barnes*).—From the place where first encountered, station 8, to station 25 this is a fairly common shell, though rather scarce at some stations. In all, 48 shells were taken. At station 15 it was known as "fantail." The shells are all relatively small and thin, and most of them exhibit the peculiarity of having a purplish nacre, only very few being white, but none so deep a purple as frequently occurs in specimens from Texas. In the Iowa and upper Mississippi Rivers, where this species attains large size and always or most always has a white iridescent nacre, it is valuable for buttons, knife handles, etc., but the thin purplish Arkansas shells are of no commercial value.

It is significant that though the greater number of these shells have colored nacre, *Lampsilis ligamentinus*, which is frequently rose tinted in the upper Mississippi, and *Quadrula coccinea*, which often has rose-tinted nacre everywhere, show little disposition here to develop colored nacre, this in the greater number of cases being white. This shows clearly that the causes producing tinted nacre are not the same for all species, and may be an individual peculiarity.

It was found at the following stations: 8, scarce; 10, scarce; 14, common; 16, scarce; 17, scarce; 18, scarce; 19, scarce; 20, scarce; 21, scarce; 22, scarce; 23, common; 24, scarce; 25, common.

Red shell, Lampsilis purpuratus (*Lamarck*).—Fairly common from station 14 to station 25, 25 shells having been secured in this portion of the river. They exhibit no variation except in size. Some of the examples are rather small, but the greater number are of good size.

The young shells are thin and fragile, but later become thick and heavy. The species closely resembles *L. alatus* in the color of nacre, which is rich purple, and that of the epidermis, which is black. It differs from that species in being considerably more inflated and with very little wing. The species is rather closely related to *L. alatus* and is said to have a wedge-shaped glochidium, which would agree with that of *alatus*. At station 15 it is known as the "red shell."

It was found at the following stations: 14, scarce; 16, scarce; 18, scarce; 20, scarce; 22, common.

Lampsilis glans (*Lea*).—Only one specimen of this small species was found. It was obtained at station 16. It is inconspicuous both in color and size and is liable to be overlooked even where fairly common.

Lampsilis ozarkensis (*Call*) *var.*—These specimens, unlike anything we could find a figure or description of, more closely resemble a very elongated *Quadrula coccinea* than anything else, agreeing with that species both in texture of epidermis and color of nacre, which is usually a rich rosy, though occasionally white. Examples were submitted to Mr. Bryant Walker, of Detroit, Mich., who has made a special study of fresh-water mussels and identified them as above. Mr. Walker remarks:

> Not typical. I have author's examples. But these agree with a shell I have, so named, from Hardy. Taken by themselves, I should say that these shells were *Pleurobemas* rather than a species of *Lampsilis*. They are not, however, Simpson's *elliptica*. Alcoholic specimens, which would enable the generic place to be established, would be desirable.

These shells also agree fairly well with specimens labeled *ozarkensis* in the Davenport Academy of Sciences, with which they have been compared.

This form was fairly common between stations 9 and 25, 20 examples having been secured.

It was found at the following stations: 9, abundant; 13, scarce; 16, common; 17, common; 20, scarce; 24, abundant; 25, scarce.

Lampsilis planicostatus (*Lea*).—Only two examples, both females, one from station 2 and one from station 24. These were submitted to Mr. Bryant Walker, who remarks, "A very interesting find. The first record west of the Mississippi, I believe. Male examples would be very desirable." The shells are elongate, somewhat resembling a long flattened *iris*, but without the brilliant radiation of that species.

Spectacle case, *Lampsilis lienosus* (*Conrad*).—Seven examples of this small species were found, all at station 8, and above Wolem. All had the nacre deep purple, and one of the small females bore a considerable resemblance to a large *Lampsilis glans*. A specimen was submitted to Mr. Bryant Walker, who identified it as above. It is a fairly common shell in southern streams.

Spectacle case, *black sand shell*, *Lampsilis rectus* (*Lamarck*).—Rather scarce. The first shells of this species were taken at station 6. In all, 46 shells were secured. One dead shell had a colony of *Plumatella polymorpha* growing on the inside of one valve. Most of the shells of this species were of medium size and rather poor quality. White-nacred shells are the rule rather than the exception, which is the reverse of the situation in parts of the upper Mississippi, where most of the shells are purplish. Where this shell attains large size and has white nacre it is an excellent commercial species. At the pearler's camp, station 15, it was called "spectacle case." In the button trade it is known as the "black sand shell," while the former name is applied to *Margaritana monodonta*.

It was found at the following stations: 6, scarce; 10, scarce; 14, common; 17, scarce; 18, scarce; 20, scarce; 21, scarce; 24, scarce; 25, common; 26, scarce.

Lampsilis venustus (*Lea*).—Not common, but well distributed, the first 11 being taken at station 3 and the last one at station 24. In all, 19 specimens were secured. Mr. Bryant Walker, to whom the specimens were referred and who identified them, in remarks concerning some of the specimens says, "On the whole they seem to be between *venusta* and *pleasii*. More material from different localities would be very desirable."

This is a small species attaining the length of about 50 millimeters. Most of the females have a peculiar sulcus extending from the post ventral margin dorsad, and the epidermis with exceedingly fine capillary rays posteriorly. Mr. Walker calls attention to their close relationship and similarity to *L. ellipsiformis* (Conrad). Call is of the opinion that *venustus* and *pleasii* are the same.

It was found at the following stations: 3, common; 8, scarce; 9, scarce; 11, scarce; 16, scarce; 24, scarce.

Green mugget, red mugget, grass mucket, Lampsilis ligamentinus (*Lamarck*).—This is much the most abundant species found in the river, and is represented by 216 shells obtained at numerous stations from station 5 down to station 26. There are four without data. Only a few of the shells have rosy nacre. There is great variation in size, form, and general appearance. Most of the various forms found in widely different localities are found in this one river, not in widely separated parts of the river, however, but in the same mussel bed. Two examples from station 5 are very thick and heavy. One other from the same place is flattish, with broad rays, and another one is small, flattened, and rayless. This latter depauperate form, resembling a style common in Green River, Ky., is a common type in the river. One specimen, collected at station 9, and one from station 23, are remarkably inflated and elongate. One shell collected at station 19 is inflated and arcuate, having the general shape of *Symphynota costata*. At station 15 a specimen with broad green bands and a greenish epidermis, the kind known by clammers along the Mississippi as the "grass mucket" was called "green mugget" and one with a rusty epidermis and no rays was called "red mugget."

Although the mucket, *Lampsilis ligamentinus*, is one of the staple shells used in button manufacture, those of the Big Buffalo River are of little commercial value on account of their general small size and lack of uniformity.

It was found at the following stations: 5, common; 6, scarce; 7, scarce; 8, very abundant; 9, very abundant; 10, very abundant; 11,

abundant; 12, abundant; 14, abundant; 16, abundant; 17, abundant; 18, abundant; 20, common; 21, common; 22, abundant; 23, abundant; 24, abundant; 25, abundant.

Lampsilis luteolus (*Lamarck*).—Rare; only two examples obtained, both at station 25. They were rather small for river shells, but heavier than the form usually found in lakes.

Butterfly, *Lampsilis ventricosus* (*Barnes*).—Not very abundant, but found distributed throughout most of the length of the stream examined. In all, 22 specimens were found. Most of the shells were well rayed. They exhibited the usual variation in form. One shell collected at station 6 is a short inflated female, bearing a general resemblance to *L. capax*, but thick. One shell, obtained at station 8, was small, well rayed, and more closely approaching the shape of *L. ovatus*, and had a yellowish epidermis well rayed with green.

It is only at its best that *L. ventricosus* is a good button shell, and those of Big Buffalo River are only moderately good shells.

It was found at the following stations: 2, one live shell; 3, abundant; 5, scarce; 6, scarce; 9, scarce; 21, scarce; 24, scarce.

Lampsilis breviculus brittsi (*Simpson*).—This shell is new to the collection of the bureau, and was identified by Mr. Bryant Walker. It agrees fairly well with examples of *breviculus* Call, in the Davenport Academy of Sciences, with which specimens were compared, but is broader and flatter posteriorly. It is a flattened shell bearing some resemblance to a small, thin, considerably produced *Lampsilis luteolus*, but not markedly inflated postero-ventrally. The numerous green rays are much interrupted and broken up by the lines of growth. Two examples from station 4 have rather rosy nacre. There are 28 shells in the collection. The first five were obtained at station 3 and the last one at station 24.

It was found at the following stations: 4, scarce; 6, scarce; 7, scarce; 9, scarce; 11, scarce; 12, scarce; 24, scarce.

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